

DEPARTMENT OF AGRICULTURE WEATHER PROGRAMS

The Nation's food and fiber products are a critical resource impacting our domestic and international economic situation and are essential for ensuring our national security and shaping foreign policy. Weather is the most important factor influencing the Nation's variability in crop yields and related production. The United States Department of Agriculture (USDA) monitors global weather and agricultural developments through the Joint Agricultural Weather Facility (JAWF). The JAWF provides critical information to decision-makers formulating crop production forecasts, programs that provide natural disaster assistance to U.S. farmers and ranchers, emergency relief programs, and trade policy. USDA operates specialized weather observing networks such as SNOTEL, SCAN, and RAWS that provide vital data and information used to forecast seasonal water supplies in the West, to support national conservation programs, and to monitor the health of the Nation's forests. USDA conducts supporting research that focuses on understanding the interactions of weather and climate with plants, animals, forests, and forest ecological systems.



Numerous agencies within the United States Department of Agriculture (USDA) require a wide range of high quality weather and climatological data to successfully carry out their missions. Some of the diverse applications that require accurate, timely, and comprehensive data include crop monitoring and weather impact assessment, agricultural yield and productivity modeling, natural resource conservation planning, forest fire potential monitoring, irrigation scheduling, water supply information, reinsurance

and compliance programs, crop disaster assistance and emergency relief programs, integrated past management, crop yield modeling, and agricultural research studies. The following is a brief description of agency weather activities.

OFFICE OF THE CHIEF ECONOMIST /WORLD AGRICULTURAL OUTLOOK BOARD

The World Agricultural Outlook Board (WAOB), in cooperation with National Weather Service's (NWS)

Climate Prediction Center, staffs and supports the Joint Agricultural Weather Facility (JAWF). Created in 1978 as an operational unit, JAWF meteorologists work as a team, monitoring global weather conditions and preparing real-time agricultural assessments (Figure 3-USDA-1). These assessments keep USDA commodity analysts, the Office of the Chief Economist (OCE), and the Secretary of Agriculture and top staff well informed of worldwide weather related developments and their effects on crops and



Figure 3-USDA-1. Joint Agricultural Weather Facility Home page.

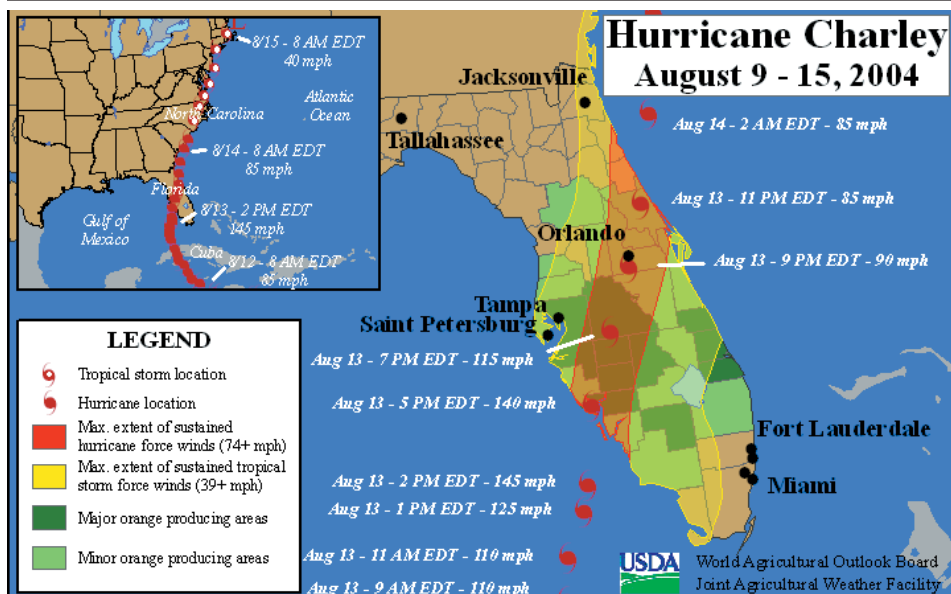


Figure 3-USDA-2. Special agricultural assessment example - Hurricane Charley.

livestock. In addition to providing these routine assessments, WAOB agricultural meteorologists are frequently requested to prepare special assessments when adverse or anomalous weather conditions (i.e., droughts, heat waves, freezes, floods) are observed in major crop producing regions. An example of an assessment made during Hurricane Charley is shown in Figure 3-USDA-2. This special assessment was prepared using sophisticated GIS tools, overlaying the track and sustained wind speeds of the hurricane over Florida orange producing areas. When integrated with economic analyses and information, these routine and special crop-weather assessments provide critical information to decision-makers formulating crop production forecasts and trade policy.

The JAWF serves as the USDA's focal point for weather data received from the World Meteorological Organization's (WMO) Global Weather Observing System. These data are used at JAWF and other USDA agencies for a number of agricultural applications. Another major source of domestic weather and climate data that is used by USDA comes from the

NWS's Cooperative Observer (COOP) Network. WAOB agricultural meteorologists merge the weather data with climatological analyses and global agronomic data, to determine the weather's impact on crop development and yield potential. Weekly briefings are provided to USDA commodity analysts and top staff. The Senate and House Agricultural Committees periodically request agricultural weather briefings that focus on the severity and impact of drought, heat waves, and excessive wetness in major crop areas around the Nation.

JAWF's flagship publication is the Weekly Weather and Crop Bulletin (WWCB). First published in 1872 as the Weekly Weather Chronicle, the publication has evolved over the past 132 years into one that provides a vital source of information on weather, climate, and agricultural developments worldwide. The publication is a shining example of how two major departments within the federal government can mutually cooperate, combining meteorology and agriculture to provide a service that benefits the economic well being of the nation (Figure 3-USDA-3). The WWCB highlights weekly meteorological and agricultural

developments on a national and international scale, providing written summaries of weather and climate conditions affecting agriculture, as well as detailed maps and tables of agrometeorological information that are appropriate for the season. The WWCB is available in electronic form over the Internet at the following address: <http://www.usda.gov/agency/oce/waob/jawf/>.

Drought is the leading hazard in economic losses each year in the United States. In the summer of 1999, a monitoring tool known as the Drought Monitor was developed to help assess drought conditions in the United States. The Drought Monitor is a collaborative effort between federal and academic partners, including the University of Nebraska-Lincoln National Drought Mitigation Center, the USDA/OCE/WAOB/JAWF, the NOAA/NWS/CPC, and the NOAA/NESDIS/ National Climatic Data Center. Eight lead authors rotate the responsibility of preparing the Drought Monitor. Produced on a weekly basis, the Drought Monitor is a synthesis of multiple indices, outlooks, and impacts depicted on a map and in narrative form. The official web site for the Drought Monitor can be found

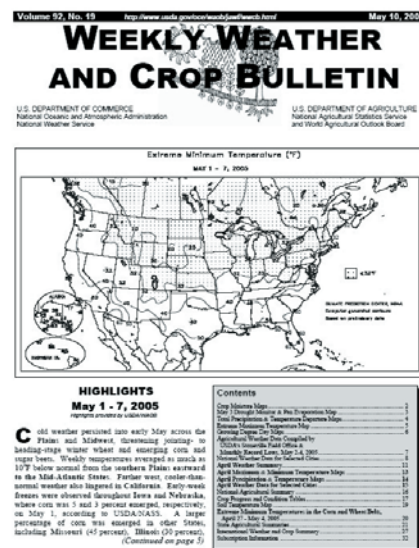


Figure 3-USDA-3. Weekly Weather and Crop Bulletin is a joint effort of between the Departments of Agriculture and Commerce.

U.S. Winter Wheat Areas Experiencing Drought

April 26, 2005

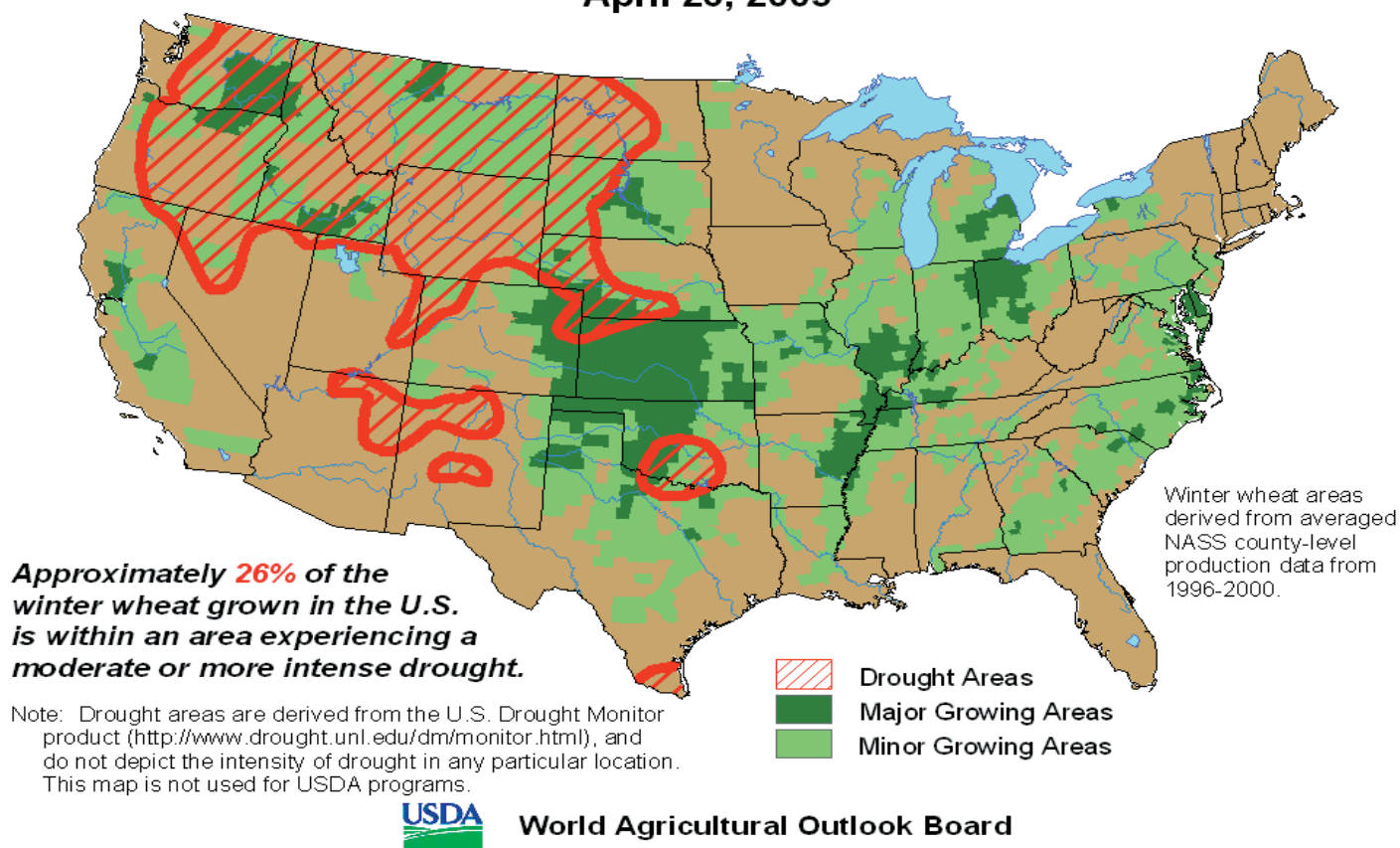


Figure 3-USDA-4. A monthly update of United States winter wheat areas experiencing moderate or more intense drought.

at <http://enso.unl.edu/monitor>. The Drought Monitor is released each Thursday at 8:30 a.m. Eastern Time. Because the Drought Monitor is prepared in a Geographic Information System, it can be overlaid on agricultural data, to quantify the spatial extent of drought affecting various agricultural commodities (Figure 3-USDA-4).

USDA's Chief Meteorologist is currently serving as the president of World Meteorological Organization's (WMO's) Commission for Agricultural Meteorology. In this position, he leads an effort to enhance the flow of more accurate and timely global agricultural weather information through an ongoing project utilizing internet technology. The World AgroMeteorological Information Service (WAMIS) is a dedicated web server that provides agrometeorological bulletins and advi-

sories issued by WMO Members to the global agricultural community and also provide training modules to aid members in improving their agrometeorological products. The WAMIS web site is: <http://www.wamis.net/>.

The WAOB/JAWF opened a field office in Stoneville, Mississippi in October 1998. The JAWF Mississippi Field Office is co-located with the Mississippi State University Delta Research Extension Center (DREC). The purpose of the co-located JAWF and DREC Data Center is to collect, quality control, and manage agricultural weather data and to make it available to the entire Mississippi Delta agricultural community, including extension service, researchers, and farmers. In a cooperative effort between USDA, Mississippi State University, Mississippi State University

Extension Service, and Meteor Communications Corporation, Inc., a meteor burst communication facility was established on Mississippi Agricultural and Forestry Experiment Station's land in Stoneville. This master communications facility is currently operational, and is being used to collect weather data from numerous meteor burst sites established in the Mississippi Delta region. Currently, there are seven meteor burst sites located in the Delta.

FOREST SERVICE

RESEARCH

Smoke from forest fires and other biomass burning is a national concern as use of prescribed fire in ecosystem management increases. Exposure of fire fighters and citizens to forest fire

smoke, changes in visibility and haze, and smoke contributions to regional and local air pollution are of concern. Forest Service Research (FSR) is the world leader in developing emissions factors from fires and modeling its dispersion. FSR has conducted research on impacts of smoke on human health; relationships between on-site meteorology and smoke dispersion; consequences of smoke to visibility in Clean Air Act Class I Areas; and potential of smoke to exacerbate ozone episodes. FSR has provided basic research to support states' air regulatory programs and EPA's development of air quality standards.

Air pollution effects (primarily ozone) remain a serious threat to forest health in some parts of the U.S. FSR is describing long-term effects of air pollution on forests of the Sierra Nevada, Colorado, and southwestern Wyoming. FSR methods for assessing air pollution are also being used in other countries (Czech Republic, Mexico, Bulgaria). Nitrogen and sulfur atmospheric deposition have been studied for many years in eastern forest watersheds, and FSR has demonstrated that increased nitrogen deposition can affect water quality and ecosystem function in western forests. FSR is investigating nitrogen deposition in selected forest ecosystems across the U.S. to improve knowledge of potential nationwide impacts.

NATIONAL FOREST SYSTEM

The weather program works with the USDA Drought Commission. It provides key liaison with the Satellite Telemetry Working Group (STWG) on satellite services and with the National Weather Service, DOI, and the National Wildfire Coordinating Group (NWCG) on the delivery of fire weather forecasting, critical for safety and effectiveness of fire fighting and for flash flood warnings. The weather program oversees the standards for over 600 remote automated weather

stations across the country. These stations form the basis for the assessment of fire danger, the pre-positioning of fire fighting resources and the conducting of prescribed fire operations. The costs include contracts for the delivery of this information to agency personnel, fire weather forecasters, and state forestry agencies that use the data in real-time for critical decisions.

WILDLAND FIRE MANAGEMENT

This program uses meteorological data and interpretation skills data for decision-making regarding wildland fire management. The Forest Service State and Private Forestry, Fire and Aviation Management program operates a network of over 600 remote automated weather stations (RAWS) in a national network of 1,500 stations. The network provides real-time information, which is key in the highly utilized weather information management system (WIMS) used by fire agencies across the country.

The agency weather program works with the predictive services unit at the National Interagency Fire Center (NIFC, Boise, ID) in providing technical support and oversight to 10 Geographic Coordination Centers and works closely with the Forest Service Research and Development staff in the oversight of the 5 fire consortia for Advanced Modeling of Meteorology and Smoke locations. This effort, in cooperation with NOAA and EPA, will provide valuable smoke forecasting and air quality information to fire and air quality programs.

NATURAL RESOURCES CONSERVATION SERVICE (NRCS)

SNOW SURVEY AND WATER SUPPLY FORECASTING - MONITORING

Snowmelt provides approximately 80 percent of the streamflow in the West. The NRCS, in partnership with other federal and state agencies, oper-

ates the Snow Survey and Water Supply Forecasting Program (SS&WSF) in 11 western states and Alaska. To accurately forecast seasonal water supplies, the program collects critical snow and climate data from high elevation snow packs in the mountainous West. The data collection system includes 922 manual snow courses and over 670 automated SNOTEL (SNOW pack TELEmetry) monitoring stations throughout the West. These data, along with information from 575 stream gauges, 310 major reservoirs, and 3,200 climatological observing stations are merged into a hydroclimatic database that is used to produce real-time watershed analyses and water supply forecasts. Monitoring is done in partnership with federal, state, and local agencies, power companies, irrigation districts, and the Provincial Government of British Columbia. This information is the basis for water management decisions under international treaties with Canada and Mexico.

The SNOTEL automated data collection system plays an important role by providing near real-time remote hydrometeorological data required to evaluate snowpacks, potential in-stream water supplies and drought risk. The SNOTEL network can provide hourly precipitation, temperature, and snowpack depletion information that significantly improves flood stage forecasts and the monitoring of other life threatening snow-related events. SNOTEL information enables emergency management agencies to effectively mitigate drought and flood damages. An added benefit during the late spring and summer is the availability of hourly climate data, which is used to monitor and assess forest and wildfire potential.

Additionally, the SS&WSF Program supports research to improve monitoring technology, data reliability, data quality, water supply forecasting, and water resource modeling.

WATER SUPPLY FORECASTS

Monthly water supply forecasts are produced each year, January through June, in partnership with the National Weather Service (NWS). The purposes of water supply forecasts are to: (1) help irrigators make the most effective use of limited water supplies for agricultural production needs; (2) assist the federal government in administering international water treaties with Canada and Mexico; (3) assist state governments in managing intrastate streams and interstate water compacts; (4) assist municipalities in planning the early management of anticipated water supplies and drought mitigation; (5) operate reservoirs to satisfy multiple use demands including hydropower generation; (6) mitigate flood damages in levied areas and downstream from reservoirs; and (7) support fish and wildlife management activities associated with species protection legislation.

During a typical forecast season, the NRCS SS&WSF Program issues approximately 11,400 seasonal water supply forecasts for 711 locations in 12 Western states. The water supply forecasts are coordinated and peer reviewed by a number of federal agencies and cooperators to ensure highest quality and accuracy. Major cooperators include the Bureau of Reclamation, Corps of Engineers, Bonneville Power Authority, state and local agencies, power utilities, irrigation districts, Tribal Nations, the Provincial Government of British Columbia, the Yukon Territory and Mexico. The primary users of this information include agricultural, municipal, industrial, hydropower, and recreation. Recent Federal legislation related to endangered species protection has placed increased emphasis on timely and accurate forecasts.

The NWCC web site provides snow data, analyses, and forecasts efficiently to approximately 80,000 users. The web site experiences over 2.4 million

accesses per month during the snow season.

DROUGHT ASSESSMENT

The SS&WSF Program provides a variety of climate and water supply products that are used to assess Western drought. These include SNOTEL snowpack and precipitation analysis in the mountains, water supply forecasts, and state Surface Water Supply Indexes (SWSI). These products are critical to the weekly production of the interagency Drought Monitor web based report. A cooperative, nationwide network of 64 Soil Climate Analysis Network (SCAN) sites in 38 states monitors soil temperatures and soil moisture to support national drought monitoring, production agriculture, and climate change research.

CLIMATE INFORMATION

NRCS provides climate data and products that directly support agriculture and conservation activities nationwide. Digital maps of monthly and annual precipitation and temperature for the U.S. are available from the NWCC web site. To meet the needs for real-time climate information and analysis, the SS&WSF Program and the NOAA Climate program are sponsoring the Applied Climate Information System (ACIS). ACIS is an Internet-based climate data delivery system that provides the NRCS field offices, USDA, and partners with Internet access to thousands of climate datasets collected by scores of federal, state, and county networks. To support agricultural modeling efforts, the NWCC is also providing serially complete (i.e., no missing data values) temperature and precipitation data for approximately 11,000 climate stations nationwide. NRCS long range planning is supported by the Generation of weather Elements for Multiple (GEM) applications model, which has been used to generate future climate data sets for more than 250 locations nationwide. GEM is being integrated

with several NRCS environmental models. Monthly precipitation averages and growing season length information required for wetlands analysis are also available from the NWCC web page at over 6,000 locations in the United States, Guam and Puerto Rico. Finally, wind roses for 237 NWS stations in the United States, plus offices in Guam and Puerto Rico are now available from the NWCC web page. A wind rose gives a very succinct but information-laden view of how wind speed and direction are typically distributed at a particular location. Wind roses are useful planning tools for agricultural and natural resource planning.

AGRICULTURAL RESEARCH SERVICE

Research in this area focuses on how annual variation in weather adversely controls crop and animal production, hydrologic processes, the availability of water from watersheds, and the environmental and economic sustainability of agricultural enterprises. Scientists are developing algorithms and decision support systems for the development of a stochastic storm-generator model and methodology to use contemporary weather radar systems to determine rainfall amounts and the spatial distribution and variability in precipitation associated with individual storms. Additional research is being conducted to integrate seasonal forecasts, other information on extended climate departures from normal and extreme events, corresponding agricultural responses, and associated uncertainties into planning and management decision aids readily useable by producers. The research is conducted in collaboration with the NOAA forecast developers.

COOPERATIVE STATE RESEARCH, EDUCATION AND EXTENSION SERVICE

Cooperative State Research, Education, and Extension Service (CSREES)

funding supports research projects that collect and process long-term weather and climatic data and provide immediate and future use as a base of information for the projection and prediction of climatic trends related to environmental impacts of human activities, soils, crops and domestic animals on agroecosystems, forest, and rangelands. Broader areas of study involve atmospheric dynamics, carbon and water cycling, and their role in global change. The impact of changes in UV and ozone level studies also fit into this broad global category.

Historical climatic changes are related to trends visible from present data gathering studies, enabling prediction of future crop production and

irrigation needs. CSREES funding supports studies on the impact of climate and weather on food and fiber production. These studies relate to forest plant growth, rangeland productivity, cropping system selection and livestock production practices.

Man's impact on climate systems is also well represented in studies of both micro- and macro-atmospheric change. These involve studies dealing with the atmospheric impact of changes in air quality, water quality and point/non-point pollution related to agricultural practices and forest and urban development. Studies on atmospheric impact on nutrient cycling and carbon sequestration are supported with CSREES funds. Research is also being sup-

ported that quantifies the impact of climate change on the incidence and severity of plant and animal diseases and pests, invasive species, and biodiversity.

The National Research Initiative (NRI) has funded a wide variety of weather and climate research. Topics have varied from a number of fundamental plant drought tolerance studies to using meteorological data to forecast market performance. Much of the support in this area is also focused on climate change. The NRI has also funded research on how land changes have influenced climate and vice versa.